Τε 16·12·20

ΓΥ

Ρυθμοί Μεταβολής στην Α.Α.Τ.

- $\frac{dx}{dt} = \upsilon = \omega A\,\text{συν}(\omega t+\phi_0)$
- $\frac{d\upsilon}{dt} = \alpha = -\omega^2 A\,\text{ημ}(\omega t+\phi_0)$
- $\frac{dp}{dt} = \Sigma F = -Dx = -m\omega^2 A\,\text{ημ}(\omega t+\phi_0)$ (D: k, k_1+k_2)

ΘΜΚΕ: $\Delta K = W_{ολ}$ ή $W_{\Sigma F}$

d(ΘΜΚΕ): $dK = dW_{\Sigma F}$

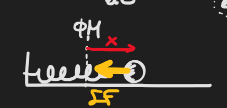
- $\frac{dK}{dt} \overset{ΘΜΚΕ}{=\!=} \frac{dW_{\Sigma F}}{dt} = \frac{\Sigma F\cdot dx}{dt} = \Sigma F\cdot\upsilon = -Dx\cdot\upsilon = -m\omega^2 A\,\text{ημ}(\omega t+\phi_0)\cdot\omega A\,\text{συν}(\omega t+\phi_0) =$

$= -m\omega^3 A^2\,\text{ημ}(\omega t+\phi_0)\cdot\text{συν}(\omega t+\phi_0)$ [θ.Α.] $\xrightarrow{\phi_0=0}$ $\frac{dK}{dt} = -m\omega^3A^2\,\text{ημ}\,\omega t\cdot\text{συν}\,\omega t = -\frac{m\omega^3A^2}{2}\cdot\text{ημ}\,2\omega t$ [θ.Α.]

⇒ αυτό είναι ένα ημίτονο, με $\omega' = 2\omega$ και πλάτος: "$\frac{m\omega^3A^2}{2}$"

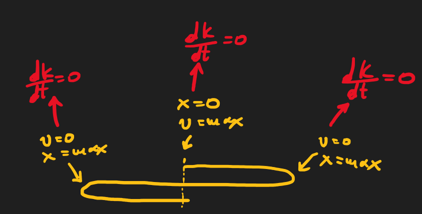
άρα: $f'=2f$ ή $T'=\frac{T}{2}$ (**)

$\text{ημ}2\theta = 2\cdot\text{ημ}\theta\cdot\text{συν}\theta \rightarrow \text{ημ}\theta\cdot\text{συν}\theta = \frac{1}{2}\cdot\text{ημ}2\theta$



$\frac{dK}{dt} = -Dx\upsilon$ ⇒ $\left.\frac{dK}{dt}\right|_{max} = DA\upsilon_{max}$ (?)

ΛΑΘΟΣ



$\left.\frac{dK}{dt}\right|_{max} = \frac{m\omega^3A^2}{2}$ ή $\frac{DA\upsilon_{max}}{2}$

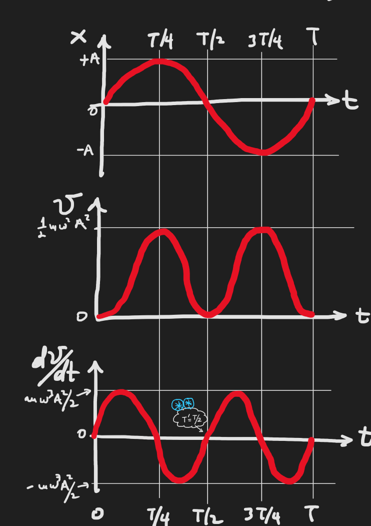
Ενέργεια του ταλαντωτή (E=K+U)

- $\frac{dE}{dt} = 0$ (γιατί E=σταθερή)
- $\frac{dE}{dt} = 0 \Rightarrow \frac{d(K+U)}{dt} = 0 \Rightarrow \frac{dK}{dt}+\frac{dU}{dt} = 0 \Rightarrow \frac{dU}{dt} = -\frac{dK}{dt} = -(-Dx\upsilon) = Dx\upsilon$ [θ.Α.] $= \cdots = m\omega^3A^2\,\text{ημ}(\omega t+\phi_0)\cdot\text{συν}(\omega t+\phi_0)$ [θ.Α.] $\xrightarrow{\phi_0=0}$ $\frac{dU}{dt} = m\omega^3A^2\,\text{ημ}\,\omega t\cdot\text{συν}\,\omega t = \frac{m\omega^3A^2}{2}\cdot\text{ημ}\,2\omega t$ [θ.Α.] - - - όμοια → $\left.\frac{dU}{dt}\right|_{max} = \frac{m\omega^3A^2}{2}$ ή $\frac{DA\upsilon_{max}}{2}$

$x = A\cdot\text{ημ}\,\omega t$

$U = \frac{1}{2}Dx^2 = \frac{1}{2}m\omega^2A^2\cdot\text{ημ}^2\omega t$

$\frac{dU}{dt} = \frac{m\omega^3A^2}{2}\,\text{ημ}\,2\omega t$



$\upsilon = \omega A\,\text{συν}\,\omega t$

$K = \frac{1}{2}m\upsilon^2 = \frac{1}{2}m\omega^2A^2\text{συν}^2\omega t$

$\frac{dK}{dt} = -\frac{m\omega^3A^2}{2}\cdot\text{ημ}\,2\omega t$